

Case Study 312

Community heating in Nottingham: an overview of a rejuvenated system



- Local government and private sector partnerships
- Generation of heat and power from waste reduces landfill requirements
- Heat supplied to domestic and commercial customers
- Reduced local and global pollution



ENERGY EFFICIENCY
DEPARTMENT OF THE ENVIRONMENT

Benefits

The benefits to the participants in the community heating scheme are:

County Council

- Local site for waste disposal
- Return on investment. A profit of £500 000 was received in the first year
- Reduces the requirement for landfill sites
- Improves the local environment

City Council

- Income from the NFFO agreement
- Source of heat for social housing and public buildings
- Burning waste recycles carbon and produces no net increase of CO₂
- Fits in with council's environmental policy
- Reduces maintenance requirement for dwellings

Commercial consumers

- Saves space. There is no requirement for individual boiler houses
- Reduced maintenance costs
- Reduced capital costs
- Instant source of heat

Domestic consumers

- Space saving
- Improved levels of comfort
- Instant source of heat
- Affordable warmth

Introduction

Nottingham has recently instigated an extensive refurbishment plan of its community heating system, originally installed in 1972. The work carried out includes:

- refurbishment of domestic properties on the scheme
- improvements to ageing pipework.

This Case Study provides an overview of the scheme and its benefits. Good Practice Case Studies 313 and 314 concentrate specifically on the domestic refurbishment and pipework upgrade carried out in 1995.

Development of Community Heating in Nottingham

In the 1960s much attention was paid to municipal improvements, including low and high rise accommodation.

At this time a shortage of landfill space in the Nottingham area for waste disposal led the council to build the Eastcroft incinerator, where waste was burnt to generate steam. Building this facility enabled the council to produce useful heat for the citizens and businesses of Nottingham whilst reducing environmental problems. The Eastcroft incinerator is now operated by Wastenotts Ltd, which is a private company wholly owned by the county council.

In 1972 an opportunity to improve the scheme was taken. The London Road heat station, a small power plant near to the Eastcroft incinerator,

What is Community Heating?

Community heating uses a large centralised boiler plant (or other heat sources) to heat a number of discrete, remote premises. Heat (usually in the form of hot water) is distributed from the central boiler plant to the community heating system's customers via well insulated underground pipes.

Community heating systems can range in size from those linking two or three buildings, through to networks which serve entire cities. By utilising central boiler plant, community heating systems can benefit from competitive fuel purchasing and can utilise alternative energy sources such as bio-fuels or combined heat and power.

Combined Heat and Power

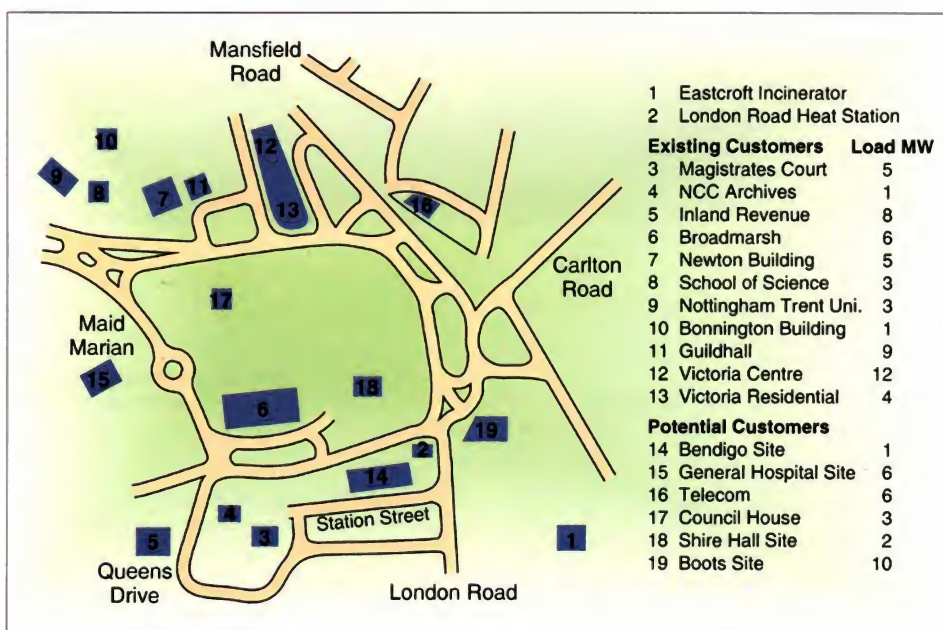
Combined heat and power (CHP) is the production of electricity and useful heat from a single plant.

When electricity is generated only a small part of the input energy is converted to electricity (typically 30-50%). The remainder of the energy consumed by the generation process is dissipated via the cooling systems as waste heat. If a suitable use for this waste heat can be found, it can be usefully recovered.

Community heating systems are ideally suited to use the waste heat from CHP power stations, to heat nearby buildings.



Waste to energy plant



Plan of the Nottingham community heating scheme

which was originally built to provide heat and electricity to the Boots factory, was purchased. The heat station was adapted to utilise steam from the incinerator to run the electricity turbines and produce hot water for the community heating system. The electricity produced was used to run the power plant and incinerator.

In 1991 a contract was awarded in accordance with the Non Fossil Fuel Obligation (NFFO), the Government's mechanism for encouraging electricity generation from renewable sources. This enabled the installation of a new electricity generation turbine. (NB NFFO is subject to competitive bids.) Currently 64% of this power is continuously sold to the National Grid. The remaining 36% is used to run the station.

The waste incineration and combined heat and power (CHP) approach adopted by Nottingham has a number of advantages:

- higher overall efficiencies than conventional electricity production
- landfill space required drops by 70%
- reduction in waste transportation costs
- reduction in CO₂ emissions from power and heat production throughout the city.

The benefits add up to a cost saving and a cleaner urban environment.

The Nottingham Scheme

The Nottingham community heating scheme has been developed to supply:

- commercial buildings
- 3600 council domestic dwellings
- around 700 owner occupier dwellings
- public sector properties.

Commercial customers include Nottingham Trent University and the Victoria Shopping Centre. A number of local authority offices are also attached to the scheme



Trent University

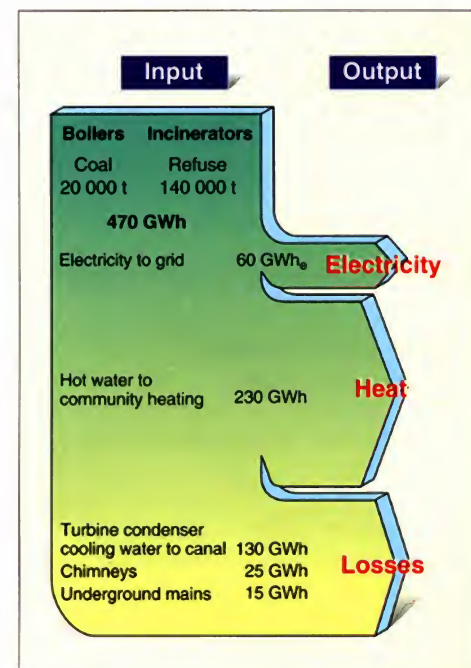


Victoria centre

Energy and Environmental Impact of the Scheme

Waste fuelled community heating has a number of energy and environmental benefits.

- By using waste over 300 GWh of fossil fuel is saved each year. This is equivalent to the heat energy used by a small town.
- Waste that would otherwise be sent to landfill is incinerated. This reduces the volume to be landfilled by 70%.
- Burning refuse recycles carbon and produces no net increase of CO₂.
- Heat delivery efficiencies of 95% are achieved.
- The continuous demand for electricity permits high utilisation contributing to the high efficiencies from the CHP scheme.
- Pollution is reduced as the flue gases are filtered and treated before emission to the atmosphere.
- Incinerator emission control has been extensively modernised to meet current legislation.
- Transportation of waste is reduced.
- The use of steam to generate electricity enables heat from the incinerators to be used all year.
- CO₂ emissions from the community are reduced by 15 000 tonne/annum compared with the use of local boilers.
- The use of waste reduces CO₂ emissions by 58 000 tonne/annum as fossil fuels are not being burned.



Available heat output of plant

Public and Private Co-operation

The development of the community heating scheme in Nottingham has come out of co-operation between public and private sector organisations. The scheme is operated by EnviroEnergy (Nottingham) Ltd through a local government and private sector partnership with Energy Technical Services Group plc (ETSG).

Customers

There are a range of benefits to the customer of the heat delivered through this scheme:

- saving of space which would normally be taken up by boiler plant
- reduced maintenance costs
- instant source of heat
- reduction of capital costs.

These benefits have persuaded many customers to connect to the scheme.

Commercial Customers Nottingham Trent University

The University has a number of major buildings on the community heating scheme. They find it a reliable and maintenance free source of heat. The university has found the cost to be competitive compared to switching to an alternative source of energy.

Victoria Centre

The Victoria Centre is a 120-outlet shopping centre in Nottingham City Centre. The communal areas are provided with heat from the community heating system. Some of the individual shopping units have also been persuaded by the benefits outlined above and they have connected to the community heating system.

Inland Revenue Building

The Inland Revenue has recently completed a prestigious development of 40 000 m². It comprises 6 four-storey 'traditional' width office blocks plus a deep plan facility for sports and catering.

A very low energy design has been adopted which maximises natural daylight and ventilation. The design scored a record maximum number of credits on the Building Research Establishment Environmental Assessment Method (BREEAM). BREEAM assesses a broad range of environmental issues of which energy consumption and CO₂ production are an important part. Generating heat for the building from waste incineration, delivered via the community heating network, helps achieve this excellent rating. The predicted energy consumption for the building is only a quarter of the value for typical air-conditioned deep plan space.

Heat from the community heating scheme was chosen after a detailed comparison with gas and electricity. Community heating proved to be the lowest cost option over a fifteen year period (shown in the table below). The inherent environmental benefits are a bonus.

Domestic Customers

The community heating scheme supplies 4300 dwellings which were originally owned by the local authority, plus 500 Housing Association homes. Most of the dwellings had partial central heating but this is now the subject of a major upgrade programme. Improvements include:

- an extension to the heating to provide radiators in every room
- improved controls
- electronic heat metering
- new prepayment meters.



Inland Revenue building

In addition, the fabric of many of the properties is being refurbished with funding from the estates action and city challenge. This work includes external cladding improvements, increasing insulation levels and double glazing.

Space heating costs (local electric units are used for hot water service)	Gas £M	Electricity £M	Community heating £M
Capital - including connection charges and plantroom	1.75	1.25	1.62
Annual - including energy and maintenance	0.064	0.093	0.057
Total cost over 15 years	2.7	2.7	2.5

Inland Revenue – heating source cost comparison

Further information

Good Practice Guides

- 1** Guidance notes for the implementation of small-scale packaged combined heat and power.
- 43** Introduction to large-scale combined heat and power.
- 115** An environmental guide to small-scale combined heat and power.

116 Environmental aspects of large-scale combined heat and power.

Good Practice Case Studies

- 81** Community heating in Sheffield.
 - 82** Consumer connection to community heating in Sheffield.
- Focus on CHP for buildings – an Energy Management Supplement, January/February 1995

The Department of the Environment's Energy Efficiency Best Practice programme

provides impartial, authoritative information on energy efficiency techniques and technologies in industry and buildings. This information is disseminated through publications, videos and software, together with seminars, workshops and other events. Publications within the Best Practice programme are shown below.

Energy Consumption Guides: compare energy use in specific processes, operations, plant and building types.

Good Practice: promotes proven energy efficient techniques through Guides and Case Studies.

New Practice: monitors first commercial applications of new energy efficiency measures.

Future Practice: reports on joint R & D ventures into new energy efficiency measures.

General Information: describes concepts and approaches yet to be established as good practice.

Fuel Efficiency Booklets: give detailed information on specific technologies and techniques.

Energy Efficiency in Buildings: helps new energy managers understand the use and costs of heating, lighting etc.